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ABSTRACT

This discussion of the efficacy of Computer Assisted Instruction (CAI) for advancing adult learning is based on the assumptions underlying pedagogy (child learning) versus andragogy (adult learning). Pedagogy versus andragogy is discussed first with respect to the prevalent design of CAI devices. Other topics covered are assumptions of andragogy and implications for CAI, versatility of the computer, and implications for further research on the interactive configuration of CAI and the nature of the adult learner. (Author/WL)

ASSESSMENT OF COMPUTER ASSISTED INSTRUCTION AS A TOOL FOR ADVANCING ADULT LEARNING

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ABSTRACT

The efficacy of Computer Assisted Instruction (CAI) for advancing adult learning is discussed. This is based on the assumptions underlying pedagogy (child learning) versus andragogy (adult learning). CAI utilizing the branching approach or adaptive technique appears to offer a potential for facilitating the adult learning process. Implications for further research on the interactive configuration of CAI and the nature of the adult learner are also discussed.

INTRODUCTION

The technology of adult education is intimately related to how adults learn. Within this frame of reference, the purpose of this paper is to investigate the utilization and effectiveness of Computer Assisted Instrustruction (CAI) as a tool for advancing adult learning.

Within the last decade, programmed self-instructional media and devices have attracted the attention and interest of educators, school administrators, the military and training personnel throughout the USA. CAI, an extension of programmed instruction allows presentation of learning material to the student and evaluation of student responses by the computer, while utilizing the capabilities peculiar to the computer. A computer based self-instructional device offers the potential of accommodating great amounts of instructional information via its inherent speed and vast storage capabilities.

The proponents of CAI offer the following features as advantages over present conventional methods of teaching and training techniques (i.e. classroom instruction employing mockups, on-the-job training and conventional type simulators).

(1) Immediate response feedback

(2) Active learner participation

(3) Adaptability to individual needs and differences

(4) Adaptability to part or whole task learning

(5) Rate of instruction and learning at the discretion of the student

(6) Utilization of time by the instructor more productively in individual guidance of students who require additional assistance

The inferences, evaluative remarks and conclusions cited herein are those of the author, based on a review of the literature of existing CAI systems, and the author's self-directed inquiry using an IBM 2741 Communication Terminal connected to a centrally located computer by telephone lines.

OVERVIEW OF CAI

Automated teaching devices within the educational community, for the most part, currently utilize essentially linear or fixed programs (i.e. the program or information presented is broken down into a predetermined sequence of small steps requiring the student to construct responses).

Such devices are of the Pressey and Skinner type teaching machines. Their role within the instructional process is either remedial in nature or one of imparting knowledge.

Pedagogy versus Andragogy

At this point of the paper it is pertinent to discuss the theoretical background underlying principles of learning with respect to prevalent design of CAI devices. With such a background, one is in a better position to evaluate CAI as a method of adult learning (i.e., andragogy). In essence, the data base reflects pedagogical principles of learning (i.e., child learning). This implies that learning is solely the process of imparting knowledge. From a traditional point of view, learning may be defined as the process of acquiring a skill, knowledge, habit or responding adequately to a situation (which may or may not have been previously encountered) through previous experience, education or training. Such is the basic philosophy underlying contemporary S-R (Stimulus-Response) or reinforcement theories of learning. Learning is a matter of developing stimulus-

response associations. In essence, it is an extension of classical conditioning. The focus of control is with the instructor or educator rather than with the learner. Programming techniques which the computer uses in computer-based instructional devices serve as the substitute for the teacher or instructor. The effectiveness of CAI as a learning tool thus becomes very much dependent on the programming capability of the machine as well as on the know-how or sophistication of the programmer.

If we restrict ourselves to perceiving the nature of adult education as compensation for learning activities of childhood and youth or remedial in nature, such a CAI approach would apply to advancing the nature of adult learning. However, adult learning is far more extensive and encompassing in scope.

> Today learning for adults goes far beyond the remedial: it deals with all the intellectual and spiritual needs that a man or woman possesses at any time of life. Education as providing the adult with something he missed as a child might be planned as an adaptation of materials and methods designed for children, although this approach was rarely successful. But an education planned for free men and women, and for all their pursuits and interests, can never be designed on some childish model, or on any model other than what is suited to the learner himself.(7)

With respect to the adult learner, learning should be pursued as a continuing lifelong process oriented towards developing self-directed inquiry within a framework of enabling the learner to minimize the gap between his present competencies and his expectancies of growth.(8) This implies a technology emphasizing an approach directed towards helping adults how to learn rather than organized around teaching adults what they should learn. (8)

In this vein, a hypothesis underlying the adult learning processes favors the cybernetic theory of learning attributed to Norbert Weiner of MIT:

> The individual is a closed-loop - feedback control system, i.e. self-regulating. Learning is the process of reorganizing feedback-regulated activity patterns into new environmental patterns. (13)

Learning efficiency comes about by a perceptual reorganization of the behavior field in such a manner as to authenticate expected consequences.

Assumptions of Andragogy and Implications for CAI

> "Andragogy is premised on at least four crucial assumptions about the characteristics of adult learners that are different from the assumptions about child learners on which traditional pedagogy is premised. These assumptions are that, as a person matures, 1.) his self-concept moves from one of being a dependent personality toward one of being a self-directing human being; 2.) he accumulates a growing reservoir of experience that becomes an increasing resource for learning; 3.) his readiness to learn becomes oriented increasingly to the development tasks of his social roles; and 4.) his time perspective changes from one of postponed application of knowledge to immediacy of application, and accordingly his orientation toward learning shifts from one of subject-centeredness to one of problem-centeredness." (8)

Versatility of the Computer

Machines which can adjust their programs as a function of student responses (a manifestation of his developmental or experiential level and specific needs) appear to offer a greater potential for heterogeneous groups of adult learners. Such devices utilize essentially the branching approach as exemplified by N. A. Crowder. It is in this context that we speak of the concept of adaptive learning devices. Learning devices whose internal operation is progressively modified to favor some response based on activity or dialogue of the student during a learning routine, are referred to as adaptive teaching machines. Modifications in program instruction are an artifact of student response based on past and anticipated behavior. The resulting man-machine configuration in this instance is analogous to a self-organizing or closed loop system.

Learning devices that utilize either general-purpose digital or analog computing elements exhibit an immediate potential for use as adaptive teaching machines. This statement is based on the knowledge of the capabilities of these two widely accepted forms of automatic computing equipment. In order for a system with a collection of inanimate electrical components to exhibit a degree of "adaptability" or "self-organizing" it must be so constructed as to contain an element of "intelligence". This "intelligence" can be imparted into the system by providing it with decision making powers which are postulated on the knowledge of the learning situation.

In the case of the analog computing element, the operations and the responses within the learning situation and the branch or alternate routes of instruction must be cast in the analog hardware. This results in hardware analogous not only to the system for which learning is being provided but also to the possible and probable methods of instruction. Thus, the resultant learning device may very well take on the form of a large, complex and inflexible system.

On the other hand, the elements of instruction of the general-purpose digital computing equipment are cast in the computer program. Through the computer program, the so-called "intelligence" is imparted to the system. The result may well be a fairly simple general-purpose digital computing equipment controlled by a highly sophisticated computer program which will cause the resultant system to exhibit a remarkably high degree of "adaptability".

RESEARCH ISSUES

In evaluating CAI systems as effective learning media, the limitations and capabilities of the role of the human operator as an information sensor and processor must also be fully understood. In this regard, specific reference is made to the human operator as the primary media used in communicating with the learning machine for controlling either information retrieval or real-time problem solving activities.

Moreover, individual differences among students must also be taken into account by users of CAI devices. This relates particularly to the interpersonal conditions of CAI and its effect on student learning. A study by Doty and Doty [4] indicated that students with high social needs do poorly under instructional methods using programmed instruction (PI). However, Traweek [14] presented evidence that the non-threatening atmosphere of PI (and CAI) assisted the learning of highly anxious subjects.

The experimental evidence of Traweek suggests CAI implications for the marginal man and the culturally and educationally deprived adult. The reason for such a conclusion (according to this writer) could be attributed to the factor of removing the threat of exposure to failure, so prevalent in their prior learning experience. Supplementing the aforementioned data, a study by Sutter and Reid [13] indicated that the lack of interpersonal contact in CAI does not hamper learning, except when conditional upon certain personality traits (i.e., need for sociability and test anxiety).

Such studies suggest a need for further research activity on the interaction between programming techniques of CAI and the nature or characteristics of the adult learner.

ABOUT THE AUTHOR

LEWIS ESTRINE is head of the Human Factors Engineering Section of the Eastern Division of GTE Sylvania. His primary responsibility is in the human factors area of development and design of training devices; and design and development of communication systems, information display systems and command and control systems. He received B.A. and M.A. degrees in psychology from New York University and the Ed. D. degree in Adult Learning from Boston University. The title of his doctoral dissertation was "The Effectiveness of Linear versus Branching Programmed Instructional Methods in Adult Cognitive Learning". Dr. Estrine is also a Visiting Lecturer in Educational Psychology at Framingham State College, Division of Continuing Education, Massachusetts. Prior to joining GTE Sylvania, he worked for Dunlap and Associates, Inc., consultants in human factors engineering, where he served as associate engineering psychologist and project engineer in areas of human factors pertaining to human engineering of equipment, systems analysis and training requirements. In earlier affiliations, he was project director in the Systems Evaluation Section of the Psychology Branch of the Human Engineering Laboratory, Aberdeen Proving Ground, Maryland; a research psychologist with the Personnel Research Branch, The Adjutant General's Office, Department of the Army (now the U. S. Army Research Institute); and an occupational analyst with the Personnel Management Branch,

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